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PATENT ABSTRACTS OF JAPAN

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(71)Applicant : **RICOH CO LTD**
(72)Inventor : **KONISHI AKIKO**
KOJIMA AKIO
NAGAI KIYOFUMI
IGARASHI MASATO
KOYANO MASAYUKI
TSUYUKI TAKANORI
MOCHIZUKI HIROTAKA
TANAKA IKUKO

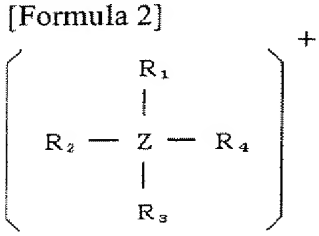
(54) COLOR INK SET FOR INKJET RECORDING AND INKJET RECORDING DEVICE LOADING THE COLOR INK SET

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain an ink set good in color tone, excellent in water resistance, light resistance and color reproducibility, and having high preservation stability and jetting stability.
SOLUTION: This color ink set for inkjet recording constituted of four colors of yellow, magenta, cyan and black, and each of which comprises water, coloring matters dissolving in the water, a wetting agent and a surfactant, includes Pro-jet Fast Yellow 2 (a bland name, produced by Zeneca corporation) and C.I. Direct Yellow 142 in the yellow ink as the coloring matters, C.I. Acid Red 52 in the magenta ink as the coloring matter, Pro-jet Fast Cyan 2 (a bland name, produced by Zeneca corporation) in the cyan ink as the coloring matter and C.I. Direct Black 168 in the black ink as the coloring matter.

CLAIMS

[Claim(s)]
[Claim 1]In a color ink set for ink jet recording with which it comprises ink of four colors of yellow, magenta, cyanogen, and black, and said each color is constituted by having colorant, a wetting agent, and a surface-active agent which dissolve in water and water at least, Said yellow ink contains Pro-Jet Fast Yellow2 (made by Zeneka Co.), and C.I.Direct Yellow142 with colorant at least, Said magenta ink contains C.I.Acid Red52 as colorant at least, A color ink set for ink jet recording, wherein said cyan ink contains Pro-Jet Fast Cyan2 (made by Zeneka Co.) as colorant at least and

said black ink contains C.I.Direct Black168 as colorant at least.
[Claim 2]The color ink set for ink jet recording according to claim 1 for which a wetting agent contained in each ink is a mixture of glycerol and a diethylene glycol, and is characterized by a thing of the ink whole quantity contained ten to 30% of the weight.
[Claim 3]********** to which a surface-active agent contained in each ink is expressed with a following general formula (1) -- and the color ink set for ink jet recording according to claim 1 or 2 characterized by a thing of the ink whole quantity contained 0.5 to 3% of the weight.
[Formula 1]
$RO(CH_2CH_20)\ nCH_2COOM$ (1)
The inside of a front type, the straight chain of the R:carbon numbers 6-14, or the branched integer M of the alkyl group n:3-12: Express an alkaline metal, the 4th class ammonium, the 4th class phosphonium, or alkanolamine, respectively.
[Claim 4]A counter ion of colorant and/or counter ion M of a surface-active agent which are contained in each ink, The color ink set for ink jet recording according to claim 1, 2, or 3 chosen from a group which consists of the 4th class ammonium expressed with sodium, lithium, and a following general formula (2), and alkanol amino ion.
[Formula 2]



(2)

The inside of a front type, Z:nitrogen or Lynn R_1 - R_4: Express hydrogen or an alkyl group of the carbon numbers 1-4, hydroxyl, and an alkyl halide group, respectively.
[Claim 5]The color ink set for ink jet recording according to claim 1, 2, 3, or 4 which is that in which ink of Isshiki contains 0.2 to 1.0% of the weight of the ink whole quantity for 1,2-benziso thiazoline as a preservation-from-decay antifungal agent at least.
[Claim 6]The color ink set for ink jet recording according to claim 1, 2, 3, 4, or 5 with which pH of each ink was adjusted to 11 or less [9 or more].
[Claim 7]An ink-jet recording device carrying the color ink set for ink jet recording according to claim 1 to 6.
[Claim 8]In a formation method of a color picture using the color ink set for ink jet recording according to claim 1 to 6, A formation method of a color picture in which it is characterized by printing a print dot corresponding to all the ink discharge openings with a scan of multiple times in the case of printing using a head which has two or more ink discharge openings when the absorption feature of a recording body of a regular paper and ink is low.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention is excellent in the ink-jet recording device carrying the color ink jetset for ink jet recording, and this color ink set for ink jet recording, especially waterproof weatherability, and a color tone and its **** opposite sex are good, It is related with the ink set for ink jet recording excellent also in preservation stability and discharging stability.
[0002]
[Description of the Prior Art]Some spread states in recent years are remarkable from an advantage, such as it being possible to a recording medium usable in various things and to obtain a color picture cheaply, and being in that speed recording is possible for an ink jet recording method, and a recording medium at it including a regular paper, since it is non-contact. In this ink jet recording, in order to continue at a long period of time and to perform good printing record, it is required for the ink to be used to fulfill the following conditions.
[0003]1. The jet direction stability of ink and jetting properties, such as discharging stability, be excellent.
2. A deposit should arise by a chemical change during that the preservation stability of ink is excellent, i.e., prolonged preservation, continuous use, or a record pause, and don't get a nozzle blocked or ink physical properties should not change.
3. It is a clear picture whose contrast of the picture by which printing record was carried out is high enough and which does not have a blot.
4. ****** of a recorded image -- a quick thing.
5. The preservability of the picture by which printing record was carried out, for example, a water resisting property, be excellent.
6. The image formation which has a color tone of a high grade and was excellent in the **** opposite sex as color ink for full color printers is possible.
[0004]In order to satisfy the above demands, much proposals are made as ink used for ink jet recording etc. until now, but the actual condition is that the ink with which it is fully satisfied of all the above-mentioned terms and conditions has not been obtained yet. These characteristics originate in the color which is colorant in the constituent which mainly constitutes ink. For example, although the clear printing image in which the contrast of the higher one is high is obtained, the concentration of a color needs for the solution stability of a color to be high, in order to raise the concentration. However, if the solution stability of a color becomes high, the preservation stability of ink and discharging stability will become high, but the water resisting property of a printing image has conversely the dilemma of worsening. In color image formation, it is important that the drying property of a printing image is also high in order to lose a boundary blot of two colors and to acquire a high-resolution picture. In addition, the color tone of each color for good color tone reappearance is also an important problem.
[0005]As an ink set for the color image formation excellent in the well-balanced waterproof lightfastness, clear nature, and mutual color rendering properties, for example by JP,8-310116,A, if the yellow which has a specific structure, magenta, cyanogen, and black dyes are combined, suppose that it is good, but. It cannot say that these colors have an enough water resisting property, and neither a color tone nor color reproduction nature can also be satisfied. According to USP-5143547, the combination of the acid . yellow 23, the direct . red 227, and the acid . blue 9 supposes that color reproduction nature is good as a combination of three colors of yellow, magenta, and cyanogen, but. The acid . yellow 23 has a bad water resisting

property, and the direct . red 227 cannot satisfy it enough in respect of a water resisting property and a color tone, either. According to USP-5145519, the combination of the direct . yellow 86, acid . REDDODO 52, and the acid . blue 9 supposes that it excels in color reproduction nature, but. The actual condition is that the ink set by the combination of the color which there is a problem of being unable to say that the direct . yellow 86 has an enough color tone, and maintained balance to all is not obtained.

[0006]Although it is difficult to solve the above problems only with a color, therefore a wetting agent, a surface-active agent, etc. are added, in order that a wetting agent may mainly raise the discharging stability of ink, and preservation stability, a surface-active agent is added in order to mainly raise the drying property of a printing image. As a role of a wetting agent, blinding by the color deposit accompanying the moisture evaporation near the nozzle etc., etc. can be prevented by dissolving colorant underwater stably. If there is much quantity of a wetting agent, the preservation stability of ink will increase, but problems, like if too large, viscosity will become high, and the regurgitation from a nozzle becomes difficult arise.

[0007]As a role of a surface-active agent, by lowering the surface tension of ink, there is an effect which improves the perviousness to the paper of ink, and ******** can be sped up by it. Even if high definition is securable in magenta, yellow, and the monochrome printing unit of cyanogen in the case of a color printer, When ****** carries out without deterioration of imaging quality, such as a blot, taking place easily in red, green, and 2 blue color pile portions and using especially an anchorage device, and ******** of ink is slow, deterioration of imaging quality, such as a boundary blot, is remarkable. The problem of a blot not arising remarkably in paper depending on the surface-active agent kind selected, and ****** not improving for an interaction with the colorant to be used might arise at that time. Problems, such as having an adverse effect on print quality, may arise because the surface-active agent itself decomposes. Only by lowering the surface tension of ink, after an ink droplet reaches paper, ink spreads in a paper face, and problems -- clearness is spoiled -- are also produced.

[0008]

[Problem(s) to be Solved by the Invention]The purpose of this invention is related with the ink-jet recording device carrying the color ink set for ink jet recording and this color ink set which canceled said conventional fault. Especially a color tone is good, is excellent in waterproof lightfastness and color reproduction nature, and there is in providing all with high preservation stability and discharging stability with the ink set which balance was able to take. The combination of the color whose the (1) 1st color tone was [the purpose of this invention] better in details and which was excellent in waterproof lightfastness and color reproduction nature, (2) The kind and addition of a wetting agent for 2nd providing the higher ink of preservation stability, (3) the structure of the surface-active agent for providing the 3rd with a clearer picture, and an addition (4) -- to the 4th. the structure of the counter ion for securing higher reliability, and (5) -- it excelling in a preservation-from-decay antifungal effect, and to the 5th, The preservation-from-decay antifungal agent kind which does not have an adverse effect on the metallic member which constitutes a head, either, and a suitable addition, (6) the suitable pH range for providing ink excellent in the preservation stability and discharging stability which suppress the corrosion of a metal department agent to the 6th, and do not have blinding in it, and (7) -- be in showing the printing method for providing the 7th with a clearer and high-definition color picture.

[0009]
[Means for Solving the Problem]This invention persons are using recording ink which combined specific colorant in colorant which dissolves in water, a wetting agent and/or a surface-active agent, and ink for ink jet recording that consists of a preservation-from-decay antifungal agent further, It can find out that offer of an ink set which was good, and was excellent in waterproof lightfastness and color reproduction nature, and balance was able to take to all with high preservation stability and discharging stability of a color tone is attained, and this invention can be reached.
[0010]In ink for ink jet recording which comprised ink of four colors of yellow, magenta, cyanogen, and black as colorant used by this invention, (1) Yellow ink contains Pro-Jet Fast Yellow2 (made by Zeneka Co.), and C.I.Dlrect Yellow142 with colorant at least, (2) Magenta ink contains C.I.Acld Red52 as colorant at least, (3) Cyan ink contains Pro-Jet Fast Cyan2 (made by Zeneka Co.) as colorant at least, and (4) black ink is C.I.DilrecCt Black168 at least. By ** using recording ink containing said colorant, a color tone is good, and is excellent in waterproof lightfastness and color reproduction nature, and offer of a color ink set for ink jet recording which maintained balance to all that are preservation stability and discharging stability -- it is high -- is attained.
[0011]If colors other than the above-mentioned color are also the ranges which do not have an adverse effect on the color tone and the other characteristics of said color as colorant contained in ink used by this invention, it will not matter even if it adds. Although an example of said such color and a color which can be used together is shown below, it is not limited to these.
(1) Acid dye, As the food color. ** C.I. acid . yellow . 17,23,42, 44, and 79,142C.I. acid . red 1,8,13, 14,18,26, 27,35,37, 42,87,89, 92,97,106, 111,114,115, 134, and 186,249,254,289C.I. acid . blue . 9, 29, 45, 92,249C.I. acid . black 1, 2, 7, 24, 26, 94C.I. acid . yellow 3, 4C.I. hood . red 7, 9, 14C.I. hood . black As a 1 and 2(2) substantivity color. ** C.I. direct . the yellow 1, 12, 24, 26, 33, 44, and 50 and 86,120,132,142,144C.I direct . red 1, 4, 9, 13, 17, 20, 28, 31, 39, 80, 81, 83, and 89,225,227C.I direct . orange . 26, 29, 62, 102, and C.I direct . blue . 1,2,6, 15,22,25, 71,76,79, 86,87,90, 98,163,165, 199,202,C.I direct . black 19,22,32, 38,51,56, 71,74,75, 77,154,171, ** is mentioned.
[0012]as a wetting agent used by this invention, it is using a mixture of a diethylene glycol and glycerin, and it became clear that the preservation stability of ink and discharging stability are markedly alike, and improve.
[0013]In this invention, a wetting agent as shown below may be used together within limits which do not have on the characteristic of this wetting agent other than the above-mentioned wetting agent. As a wetting agent which can be used together, ethylene glycol, triethylene glycol, A polyethylene glycol, polypropylene HIREN glycol, 1, 5 pentanediol, 1, 6 hexanediol, 1 and 2, 6 hexane triol, 1 and 2, 4 butanetriol, Polyhydric alcohol classes, such as 1, 2, 3 butanetriol, and all [PETORI], Ethylene glycol monoethyl ether, ethylene glycol monobutyl ether, Diethylene glycol monomethyl ether, diethylene glycol monoethyl ether, Diethylene-glycol monobutyl ether, tetraethylene glycol monomethyl ether, Polyhydric alcohol alkyl ether, such as PUROHIREN glycol monoethyl ether. Polyhydric alcohol aryl ether, such as ethylene glycol monophenyl ether and ethylene glycol monobenzyl ether, Although nitrogen-containing heterocyclic compounds, such as 2-pyrrolidone, N-methyl-2-pyrrolidone, an N-hydroxyethyl 2-pyrrolidone, 1,3-dimethyl IMIIDAZORIJINON, and epsilon-KABURO lactam, etc. are mentioned, this invention is not limited to these. Although

used in 30 or less % of the weight of the range 10% of the weight or more as content of a wetting agent, it is 20 or less % of the weight of 12 % of the weight or more more preferably. If the solution stability of a color will be insufficient, a color deposit by a nozzle part will take place easily, if there are few humid doses than 10 % of the weight, and a humid dose exceeds 30 % of the weight, thickening of ink accompanying an environmental temperature change will pose a problem.

[0014]It is using a surface-active agent expressed with a following general formula (1) as a surface-active agent used by this invention, and drying property is quick and offer of a clear color picture without a boundary blot and a character blot was attained.

[Formula 3]

$RO(CH_2CH_20)\ nCH_2COOM$ (1)

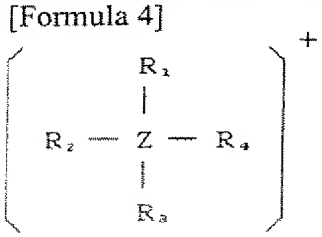
The inside of a front type, the straight chain of the R:carbon numbers 6-14, or the branched integer M of the alkyl group n:3-12: Express an alkaline metal, the 4th class ammonium, the 4th class phosphonium, or alkanolamine, respectively.

[0015]In this invention, a surface-active agent as shown below may be used together within limits which do not have on ink characteristics other than the above-mentioned surface-active agent. As a surface-active agent which can be used together, (1) polyoxyethylene alkyl ether, Polyoxyethylene alkyl phenyl ether, polyoxyethylene glycol ester, Or anionic system surface-active agent **, such as the Nonion system surface-active agents, such as an acetylene series surface-active agent and a silicon system surface-active agent, (2) polyoxyethylene-alkyl-ether acetate, and dialkyl sulfosuccinate, are mentioned. Specifically as an Nonion system surface-active agent, it can obtain as BT series (Nikko Chemicals) NONIPORU series (Mitsuhiro transformation) and SAFUI Norian series (air products) silicone (Dow Corning, Toray Industries, etc.). As an anionic system surface-active agent, it can specifically obtain as NIKKOL ECT series (a trade name, Japanese surfactant industrial chemistry company make) etc.

[0016]Said surface-active agent lowers surface tension of ink, are added in order to speed up the ****** of a printing image by raising perviousness to paper of ink, and the addition, Surface tension of ink is adjusted so that 50 or less mN/m may usually turn into 40 or less mN/m preferably, and 0.5 to 3.0 % of the weight is preferred to the aqueous ink composition whole quantity. If an addition of said surface-active agent has bad drying property since dynamic surface tension is high when less than 0.5 % of the weight, and there are conversely than 30 % of the weight, a deposit of a surface-active agent etc. will produce it at the time of preservation. [more]

[0017]A counter ion of the above-mentioned color and counter ion M of a surface-active agent Sodium, When chosen out of a group which consists of the 4th class ammonium and the 4th class phosphonium which are shown with lithium and a following general formula (2), and alkanolamine ion, outstanding solution stability and a good printing image are obtained.

[Formula 4]



(2)

The inside of a front type, Z:nitrogen or Lynn R_1 - R_4: Express hydrogen or the alkyl

group of the carbon numbers 1-4, hydroxyl, and an alkyl halide group, respectively. In order to use a counter ion as such alkali salt, when dissolving these in water at the time of ink adjustment, it can carry out easily by acting as former Kuwae of the alkaline-water oxide having contained desired alkaline ion. For example, in the case of lithium salt, it can carry out by adding lithium hydroxide.

[0018]As a preservation-from-decay antifungal agent used by this invention, it was using 1,2-benziso thiazoline 3-one, and it turned out that ink and a color picture which are excellent in a preservation-from-decay antifungal effect can be provided, securing reliability, such as preservation stability and discharging stability. As an addition of a preservation-from-decay antifungal agent, 0.2 to 1.0 % of the weight is preferred. If there are few additions than 0.2 % of the weight, a preservation-from-decay antifungal effect will become insufficient, and if an addition exceeds 1.0 % of the weight, a deposit of the preservation-from-decay antifungal agent itself may pose a problem. As a preservation-from-decay antifungal agent containing 1,2-benziso thiazoline 3-one marketed, SANAI back AP (made by San-Ai Oil Co., Ltd.), the pro cheating on the fare XL (I. product made from C.I), etc. are mentioned.

[0019]It turned out that especially ink of this invention can be provided as ink are adjusting pH to 11 or less [9 or more] in consideration of influence on metal used for a nozzle plate, and more reliable. In this invention, it ** in day and a penetrating agent, a metallic corrosion depressant, a water-soluble ultraviolet ray absorbent, a water-soluble infrared absorption agent, etc. can also be added.

[0020]

[Example]the following -- the example of this invention -- and a comparative example -- it is shown.

[0021]

The presentation of example 1 ink (presentation of yellow ink)

Pro-Jet Fast Yellow2 (made by Zeneka Co.). 1.5 % of the weight C.I.Direct Yellow142 (DAIWA Chemicals color) 0.5-% of the weight diethylene glycol 15-% of the weight glycerin 5-% of the weight ECTD-3NEX (Nikko Chemicals) 1-% of the weight SANAI back AP (made by San-Ai Oil Co., Ltd.). 0.4-% of the weight ion exchange water 76.6 % of the weight (presentation of magenta ink)

C. I.Acild Red52 (DAIWA Chemicals color). 2 of a 1.3-% of the weight compound example 0.7-% of the weight SHIECHIREN glycol 15-% of the weight glycerin 5-% of the weight ECTD-3NEX (Nikko Chemicals) 0.4 % of the weight of 1-% of the weight pro cheating-on-the-fare XL (I. product made from C.I) ion exchange water 76.6 % of the weight (presentation of cyan ink)

Pro-Jet Fast Cyan2 (Zeneka color). 3-% of the weight diethylene glycol 15-% of the weight glycerin 5-% of the weight ECTD-3NEX (Nikko Chemicals) 1-% of the weight SANAI back AP (made by San-Ai Oil Co., Ltd.) 0.4-% of the weight ion exchange water 75.6 % of the weight (presentation of black ink)

C. I.Direct Black168 (Zeneka color) 3-% of the weight diethylene glycol 15-% of the weight glycerin 5-% of the weight ECTD-3NEX (Nikko Chemicals) 0.4 % of the weight of 1-% of the weight pro cheating-on-the-fare XL (I. product made from C.I) ion exchange water 74.6 % of the weight[0022]After it carried out the churning dissolution of each ink composition prescribed by the above-mentioned presentation in the room temperature and lithium hydroxide adjusted pH to 10.5, it filtered with a 0.22-micrometer Teflon filter, and also deaeration for about 30 minutes was performed, and example 1 ink was produced. Next, any examination was O when the examinations 1-4 shown below were done about this ink.

[0023]Examination 1: The image sample printed in waterproof evaluation example 1

ink of the printing image was immersed in 30 ** water for 1 minute, change of the image concentration before and behind immersion was measured with the Macbeth densimeter, and it asked for the water resisting property (fading rate %) by the following formula, and when a fading rate was less than 30%, it was considered as x at O and not less than 30% of case.

[Equation 1]

$$\text{退色率（%）} = 1 - \frac{\text{処理後の画像濃度}}{\text{処理前の画像濃度}} \times 100$$

Examination 2: In the evaluation example ink of picture clear nature, the color picture was printed and a picture blot, a color tone, and concentration were synthetically judged by viewing. As a print form, it printed on 3 papers of commercial recycled paper, a copy paper, and an ink jet dedicated paper, and in the case of the good picture, any paper was made into O, and made except [its] x.

[0024]Examination 3: Evaluation each ink of preservation stability was put into the polyethylene container, it saved for two months under each conditions at -20 **, 20 **, and 50 **, and the surface tension after preservation, viscosity, and the existence of the settlings deposit were investigated. Even if saved on which conditions, what there is no change of physical properties etc. and precipitate is not regarded as was made into O, and except [its] was made into x.

[0025]Examination 4 :. The reliability evaluation nozzle plate after long-term neglect was formed with nickel. The ink jet printer which has a nozzle of 300dpi which uses the lamination PZT for the application of pressure of a fluid chamber channel is filled up with example 1 ink, Into a room temperature, reach 0 times, perform cleaning operation, such as after neglect between three pieces, wiping, and suction, once, it was made to print in the state where it capped, and comparison of the pixel diameter before and behind neglect and dot position accuracy was performed. By zero cleaning ****, when the case where there is no problem in a pixel diameter and dot position accuracy was recovered by O and one cleaning operation, ** and except [its] were made into x.

[0026]Ink was produced by the presentation of the comparative example 1 following.

(Presentation of yellow ink)

C. I.Acid Yellllow23. 1.5-% of the weight diethylene glycol 15-% of the weight glycerin 5-% of the weight ECTD-3NEX (Nikko Chemicals) 1-% of the weight SANAI back AP (made by San-Ai Oil Co., Ltd.) 0.4-% of the weight ion exchange water 77.1 % of the weight (presentation of magenta ink)

C. I.Dilrect Red227 3-% of the weight diethylene glycol 15-% of the weight glycerin 5-% of the weight ECTD-3NEX (Nikko Chemicals) 1-% of the weight SANAI back AP (made by San-Ai Oil Co., Ltd.) 0.4-% of the weight ion exchange water 75.6 % of the weight (presentation of cyan ink)

C. I.Direct Blue199 3-% of the weight diethylene glycol 15-% of the weight glycerin 5-% of the weight ECTD-3NEX (Nikko Chemicals) 1-% of the weight SANAI back AP (made by San-Ai Oil Co., Ltd.) 0.4-% of the weight ion exchange water 75.6 % of the weight (presentation of black ink)

C. I.Direct Black154. 3-% of the weight diethylene glycol 15-% of the weight glycerin 5-% of the weight ECTD-3NEX (Nikko Chemicals) 0.4 % of the weight of 1-% of the weight pro cheating-on-the-fare XL (I. product made from C.I) ion exchange water The churning dissolution of each ink composition prescribed by the above-mentioned presentation 75.6% of the weight is carried out in a room temperature, After lithium hydroxide adjusted pH to 10.5, it filtered with a 0.22-

micrometer Teflon filter, and also deaeration for about 30 minutes was performed, and comparative example 1 ink was produced. Next, about this ink, when the above-mentioned examinations 1-4 were done, the water resisting property and the color tone became a problem.

[0027]Ink was produced by the presentation of the comparative example 2 following. (Presentation of yellow ink)

Pro-Jet Fast Yellow2. (Zeneka color) 2-% of the weight 1,5-pentanediol 10-% of the weight glycerin 2-% of the weight ECTD-3NEX (Nikko Chemicals) 1-% of the weight SANAI back AP (made by San-Ai Oil Co., Ltd.) 0.4-% of the weight ion exchange water 84.6 % of the weight (presentation of magenta ink)

C. I.Acild Red52 (DAIWA Chemicals color) 18-% of the weight 1,5-pentanediol 10-% of the weight ECTD-3NEX (Nikko Chemicals) 1-% of the weight SANAI back AP (made by San-Ai Oil Co., Ltd.) 0.4-% of the weight ion exchange water 84.8 % of the weight (presentation of cyan ink)

Pro-Jet Fast Cyan2 (Zeneka color). 3-% of the weight diethylene glycol 5-% of the weight glycerin 2-% of the weight ECTD-3NEX (Nikko Chemicals) 1-% of the weight SANAI back AP (made by San-Ai Oil Co., Ltd.) 0.4-% of the weight ion exchange water 88.6 % of the weight (presentation of black ink)

C. I.Direct Black168 (Zeneka color). 4-% of the weight diethylene glycol 23-% of the weight glycerin 10-% of the weight ECTD-3NEX (Nikko Chemicals) 1-% of the weight SANAI back AP (made by San-Ai Oil Co., Ltd.) 0.4-% of the weight ion exchange water The churning dissolution of each ink composition prescribed by the above-mentioned presentation 61.6% of the weight is carried out in a room temperature, After lithium hydroxide adjusted pH to 10.5, it filtered with a 0.22-micrometer Teflon filter, and also deaeration for about 30 minutes was performed, and comparative example 2 ink was produced. Next, about this ink, when the above-mentioned examinations 1-4 were done, in any ink, the reliability after long-term neglect became ** or x.

[0028]In the presentation of comparative example 3 example 1 ink, the surface-active agent was changed into Nonion system surface-active agent BT-7 (Nikko Chemicals), and also comparative example 3 ink was produced as the same presentation. Next, about this ink, when the above-mentioned examinations 1-4 were done, the clear nature of the printing image became x. The examination 5 shown below using example 1 ink and comparative example 3 ink was done.

[0029]Examination 5: The boundary blot by the printing image with one scan and a printing image with two scans and the blot of a character were evaluated using the ink of the clear nature example 1 of the picture by a printing method, and the ink of the comparative example 3. The print form was judged by viewing using 3 papers of commercial recycled paper, a KOHI paper, and an ink jet dedicated paper.

[Table 1]

印字方法による画像鮮明性の評価結果

	1回スキャンによる印字		2回スキャンによる印字	
インク種	境界滲み	文字滲み	境界滲み	文字滲み
実施例1インク	○	○	◎	◎
比較例3インク	×	×	△	△

O : there is also no blot which met textiles and the dot is held on textiles.
O : although there is a blot which met textiles, visually, don't understand.
**: A blot is known a little visually.
x: A blot is known.
it was checked that the direction which prints with two scans is markedly alike compared with printing with a scan once, and its boundary blot by 2 color piled part improves as shown in Table 1.
[0030]In the presentation of comparative example 4 example 1 ink, the preservation-from-decay antifungal agent was removed, and also comparative example 4 ink was produced as the same presentation.
[0031]In the presentation of comparative example 5 example 1 ink, the preservation-from-decay antifungal agent was changed into SANAI back AP100, and also comparative example 5 ink was produced as the same presentation. Next, the examinations 6 and 7 shown below were done to example 1 ink, the comparative example 4, and 5 ink.
[0032]Examination 6: To preservation-from-decay antifungal examination each ink 100m1, inoculate test organism object * and mixed spore suspension ** 1% respectively day by day [predetermined], put in and cultivate in the homoiothermal layer adjusted to 28**2 **, and investigate the existence of growth of a bacillus by the shake culture method after two days. The repetition deed and the preservation-from-decay antifungal effect were judged for this cycle 10 times.
* Test organism object suspension : the following strain was put into bouillon culture liquid, and it was suspended.
Bacillis Subtilis, Escherichia coli, Proteus vulgaris, Pseudomonas aeruginosa, Staphylococcus aureus** mixing spore suspension: Make the 0.005% solution of the dioctyl sodium sulfosuccinate with an Erlenmeyer flask, and sterilize with autoclave. Next, it takes one platinum loop of spores of the following test organisms at a time, and, in addition to this, a spore is fully distributed. It filters through the filter paper which sterilized contents by hot air, and receives in another flask.
* ** bouillon culture liquid : what sterilized by 121 ** and the autoclave for 15 minutes after dissolving the meat extract 3g, the peptone 10g, and 5 g of sodium chloride in the distilled water of 1 1000 m.
10 cycles considered the case where it was not generated by the bacillus as O, and the judgment made except [its] x.
[0033]Examination 7 : the nickel plate (surface area of 2 cm) in which the orifice was made to form to 20 ml of corrosion behavior examination each ink, It was made to dip, and was neglected for two weeks in the environment of 60 **, and it was measured in ICP (inductilvelycoupled plasma) spectrographic analysis whether the

nickel ion in ink would change before and after an examination. When the increase of stock of nickel ion made the case of 2 ppm or less O and exceeded 2 ppm before and after an examination, it was considered as x.
[Table 2]

試験結果

	防腐防かび試験	金属腐食性試験
実施例１インク	○	○
比較例４インク	×	○
比較例５インク	○	×

It was checked that example 1 ink is excellent in a preservation-from-decay antifungal effect, and does not cause metallic corrosion as shown in the front table 2.
[0034]In comparative example 6 example 1 ink, it was considered as comparative example 6 ink without performing pH adjustment. Next, when the examinations 4 and 7 were done to comparative example 6 ink, it became x with yellow ink and cyan ink.
[0035]
[Effect of the Invention]1. By using the ink which combined the color of claim 1 specification, it excelled in waterproof lightfastness, and image concentration was also high, and the color tone was also good, and offer of the high-definition color picture outstanding at ******** was attained.
2. By making the wetting agent of claim 2 specification contain, offer of the ink and the color picture which were more excellent in preservation stability and discharging stability was attained.
3. By making the surface-active agent of claim 3 specification contain, offer of the clear color picture which is quick-drying capability and does not have a character blot and a boundary blot was attained.
4. By using the counterion of claim 4 specification, offer of more reliable ink and a color picture was attained.
5. By using the preservation-from-decay antifungal agent of claim 5 specification, offer of reliable ink and a color picture excellent in the preservation-from-decay antifungal effect was attained, with high-reliability secured.
6. Offer of the ink and the color picture which were excellent in the preservation stability and discharging stability which suppress metallic corrosion and do not have Mari Hizume by adjusting claim 6pH to a specific field was attained.
7. By making the ink set of claim 7 and 8 aforementioned each claim carry, the formation method of the ink-jet recording device which can do so the effect corresponding to each ink set, and the ink jet color picture was acquired.

[Translation done.]